- enclosing conveyors for moving coal at the plant site and placing dust collector devices at transfer points in the system;
- equipping dust collector devices with high efficiency fabric filters;
- compacting the inactive coal storage pile and spraying it with an encrusting agent;
- adding a wet suppressant, or surface-active chemical agent, at the rail car unloading hopper to reduce dust emissions in the coal unloading building and at the active coal pile;
- covering trucks delivering material (coal and lime) to the plant;
- paving all plant roads, including those roads used by trucks to haul the combustion by-product to the on-site disposal area; and
- cleaning plant roads by watering on an as needed basis.

Based upon the techniques outlined by Delmarva Power, the State believes that reasonable precautions are being taken by the utility to prevent fugitive PM from becoming airborne. Delmarva Power has specified the controlled PM emissions of the fly ash fabric filter devices to be 0.003 grains/actual cubic feet per minute (acfm) (Colla 1994). This control efficiency is consistent with that required for dust collector devices in similar service at recently permitted sources in Maryland.

2.3.3.5 *Continuous Emissions Monitoring*

Utilities are required to provide monitoring of emissions by several provisions of the CAA. Regulations applicable to the proposed Dorchester power plant containing monitoring requirements are as follows:

- NSPS, 40 CFR Part 60, Subpart Da (main boiler) and Subpart Dc (auxiliary boiler);
- Acid Rain program (Title IV), 40 CFR Part 75;
- Title VIII CO_2 emissions tracking;
- The Enhanced Monitoring program under Title V, proposed as 40 CFR Part 64; and
- COMAR 26.11.01.

The following discusses the different regulations with a summary of key requirements.

NSPS Requirements

The main coal-fired unit is subject to Subpart Da, and the auxiliary boiler is subject to Subpart Dc, of the NSPS. Under Subpart Da, the Dorchester coal-fired boiler will be required to monitor for NO_x, SO_2, and opacity. NO_x and SO_2 are calculated in the units of nanograms per joule or lbs/MMBtu. Additionally, SO_2 control efficiency must be measured. To measure the control efficiency, SO_2 is monitored at the inlet and outlet of the SO_2 control device. To correct for dilution by air, the monitored values are corrected to 0 percent excess air. The continuous emissions monitoring systems (CEMS) measure gas (O_2 or CO_2) concentration to correct to 0 percent excess air.

The NSPS requires facilities to submit quarterly summary reports containing the following:

- a 30-day rolling average for NO_x and SO_2 in terms of lb/MMBtu;
- a 30-day rolling average SO_2 control efficiency;
- fuel property information needed for emissions calculations;
- a summary of when pollutant sampling was performed manually due to malfunctions of the CEMS;
- information on CEMS operation and performance; and
- any modifications to the CEMS that affect the ability of the CEMS to comply with the applicable performance standards.

In accordance with Subpart Dc, SO_2 emissions from the oil-fired auxiliary boiler may be monitored by measuring the sulfur content of the fuel prior to combustion in lieu of installing a CEMS. A certification of fuel sulfur content from the fuel supplier will meet this requirement.

Acid Rain Requirements

The Title IV Acid Rain regulations (40 CFR Part 75) require the monitoring of CO_2, NO_x, opacity, SO_2, volumetric flow, and a diluent gas (either O_2 or CO_2). The major difference between these and the NSPS requirements is that the Title IV SO_2 emission measurements are in units of pollutant mass per time (i.e., lb/hr); in the NSPS, the units are pollutant mass per energy (i.e., lb/MMBtu). The Title IV SO_2 monitoring requirements include the measurement of SO_2 concentration (in parts per million (ppm)) and volumetric gas flow (in standard cubic feet per hour) to obtain SO_2 mass emission rates (in lb/hr). The NO_x monitoring requirements include the measurement of NO_x concentration, the volumetric gas flow, and the heat input of the fuel (MMBtu/hr) to obtain NO_x emissions relative to heat input of the fuel (in lb/MMBtu). Title IV also requires the installation of an opacity monitor. The monitoring systems must be connected to an automated data acquisition and handling system for measuring and recording the emissions that are discharged to the atmosphere.

All monitoring equipment must meet the equipment, installation and performance specifications as described in Appendix A of 40 CFR Part 75. The CEMS also must be operated in accordance with the quality assurance and quality control procedures that are described in Appendix B of 40 CFR Part 75. The operator shall monitor and record the heat input for every hour or part of an hour that fuel is combusted as described in Appendix F, 40 CFR Part 75.

Title VIII of the Act requires the tracking of CO_2 emissions. The Title VIII regulations are incorporated into 40 CFR Part 75. Facilities are required to report annual emissions of CO_2 to develop an emissions inventory which could serve as a baseline for potential future mandated reductions in emissions. EPA has made an allowance for utilities to calculate CO_2 emissions instead of monitoring them.

Enhanced Monitoring Requirements

The proposed Enhanced Monitoring program regulations (40 CFR Part 64) affect utility units having federally enforceable conditions and potential pollutant emissions that are 30 percent or more of the major source criteria. For example, all units emitting more than 30 TPY in an SO_2 attainment area would be subject to enhanced monitoring since the major source criteria for SO_2 in such an area is 100 TPY.

The enhanced monitoring regulations provide facilities with the option to propose parameter monitoring in lieu of direct measurement of emissions. For example, in the absence of a control system and a regulatory requirement for direct measurement, fuel sulfur content and fuel consumption could be proposed in place of direct SO_2 monitoring. Parameter monitoring can be used if the correlation between the parameters and the emissions can be established.

The NSPS monitoring requirements provide sufficient monitoring to comply with the proposed Enhanced Monitoring program for SO_2, NO_x, and opacity. The currently proposed enhanced monitoring regulations would apply to CO and VOC emissions from the proposed Dorchester plant.

COMAR Requirements

COMAR 26.11.01.10 contains CEMS requirements applicable to both proposed and existing equipment. In addition, these regulations require the facility to install data telemetry linked to MDE for all required CEMS. This would allow MDE to verify compliance at any given time. A CEMS monitoring plan must be submitted to MDE for approval prior to installation.

2.3.3.6 *Summary*

Based on information submitted by Delmarva Power and the results of additional analyses performed by the State, the following summarizes the evaluation of the air emissions controls proposed for the Dorchester Unit 1 plant.

- To satisfy BACT requirements, consistent with other similar permitted units, Delmarva Power must comply with an SO_2 emission limit of 0.31 lb/MMBtu; the SO_2 control equipment must operate with a minimum control efficiency of 93 percent.
- The sulfur content of the No. 2 fuel oil used in the auxiliary boiler and for startup and stabilization of the main boiler may not exceed 0.05 percent.
- Delmarva Power's proposed NO_x emission limit of 0.17 lb/MMBtu, achieved through the use of low-NO_x burners and SCR technology, is LAER for the proposed unit based on a review of other similar permitted units. Compliance with this limit must be demonstrated on a 24-hr (block) average basis.
- NO_x emissions offsets must be obtained by Delmarva Power prior to the proposed plant becoming operational.
- Good combustion practices will achieve BACT for CO and VOC emissions, and a filter baghouse with a 99.9 percent control efficiency will achieve BACT for PM emissions, including trace metals, for the main boiler.
- Delmarva Power will employ proper techniques to minimize the generation of fugitive dust by all coal-, lime-, and fly ash-handling activities at the proposed site; fabric filter device emissions shall not exceed 0.003 grains/acfm for fly ash handling operations.
- Delmarva Power must comply with CEMS requirements as specified in the NSPS, the Acid Rain program (Title IV) (including CO_2 emissions tracking), the final Enhanced Monitoring program regulations, and COMAR.

3.0 EXISTING SITE CONDITIONS

3.1 CLIMATOLOGY/AIR QUALITY

3.1.1 Climatology

Data from the Federal Aviation Administration Flight Service Station (FSS) located at the Salisbury Airport in Wicomico County, 37 km (23 miles) southeast of the Dorchester site, provide the basis for the following discussion of climatology for the Dorchester site and surrounding area. The FSS is the closest meteorological station with a complete, extended set of meteorological data, and has been recording weather observations at the airport (e.g., wind speed and direction, temperature, precipitation) for over 40 years.

The Dorchester site and surrounding area is located in the middle latitudes, where the general atmospheric flow is from west to east. The area is within the temperate continental climate zone of the eastern US, which experiences long, warm, and often humid summers caused by the persistence of maritime tropical air. Air mass exchanges can occur frequently in the summer, due to the influence of either maritime tropical air or continental polar air. Generally pleasant weather prevails in the spring and autumn. The coldest weather occurs in January (with a monthly mean minimum daily temperature of 26.9°F), while the warmest weather occurs in July (with a monthly mean maximum daily temperature of 86.1°F). The climatological annual absolute maximum and minimum temperatures are 101°F and -5°F, respectively (Delmarva Power, Phase II CPCN application, 1993). Precipitation in the region is generally evenly distributed throughout the year, although a small maximum occurs in August. The mean annual precipitation for the climatological period of record (1961-1990) is approximately 45 inches (Delmarva Power, Phase II CPCN application, 1993).

Prevailing winds generally are from the southwest, except during the winter months when they generally are from the north-northwest. The windiest period of the year extends from late winter to early spring. Although winds may reach 50 to 60 miles per hour (mph) or even higher during severe summer thunderstorms, hurricanes, and winter storms, hourly average wind speeds near the surface rarely exceed 30 mph. Calm wind conditions prevail for approximately 23 percent of the hours in a year. The annual average wind speed is 7.2 mph. Figure 3-1 presents an annual average wind rose based on FSS data for the period 1987 to 1991.

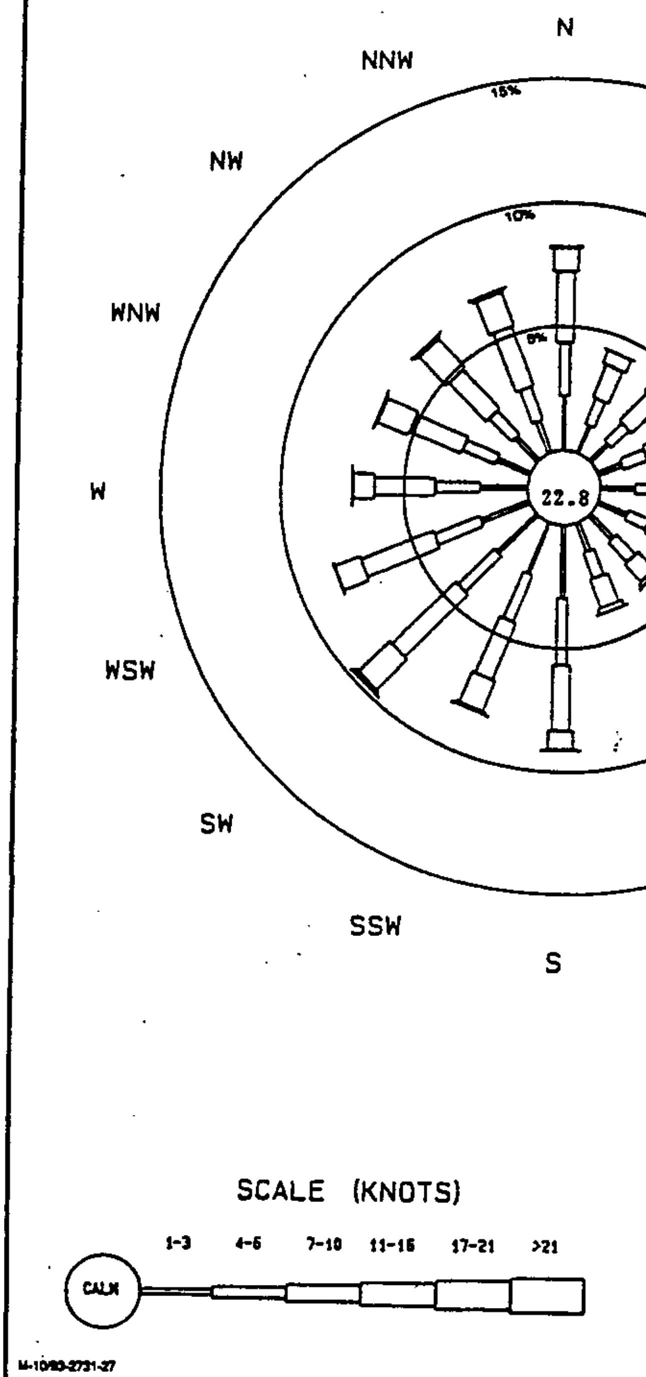


Figure 3-1
Annual Wind Rose,
Salisbury Airport
1987 Through 1991

Thunderstorms occur an average of 28 days per year, mainly during the late spring and summer (Delmarva Power, Phase II CPCN application, 1993). Heavy rains, strong winds, and occasional hail can occur during thunderstorms, or convective storm activity. Tornadoes are a rare phenomenon. Tropical storm passage over the Delmarva Peninsula is an uncommon event; these storms generally approach the area during the period of mid-August to late-October.

3.1.2 *Air Quality*

The Dorchester site is located in eastern Dorchester County, which is part of the Eastern Shore Interstate Air Quality Control Region. USEPA has designated the region as unclassifiable or in attainment of the NAAQS for SO_2, NO_2, PM_{10}, CO, and ozone (40 CFR Part 81.321).

Existing ambient air quality monitoring data can be used to describe the air quality specific to the Dorchester site and surrounding area. Delmarva Power conducted an ambient air quality monitoring program in the Vienna area from February 1982 through March 1983 to collect SO_2 and NO_2 concentrations, and from March 1989 through December 1989 to collect PM_{10} concentrations. The nearest MDE monitoring station is located in Salisbury, Maryland, approximately 27 km (6.8 miles) southeast of the proposed plant site. The Salisbury station has measured PM_{10} concentrations since 1990.

Delmarva Power has processed the SO_2, NO_2 and PM_{10} concentration measurements into averaging periods consistent with the averaging periods for the SO_2, NO_2 and PM_{10} NAAQS. As shown in Table 3-1, the highest concentrations for each pollutant and applicable averaging period are well below the NAAQS. Note that the highest 24-hr and annual average PM_{10} concentrations (91 $\mu g/m^3$ and 25$\mu g/m^3$, respectively) measured by the MDE monitor at Salisbury in 1990 confirm Delmarva Power's measurements. Despite the fact that the SO_2 and NO_2 monitoring program was conducted more than 10 years ago, these data should still be representative of the air quality of the region because of the lack of source emissions growth in the Vienna area over this time period.

Table 3-1 *Summary of Maximum SO_2 and NO_2 Concentrations Measured by Delmarva Power During the 1982-1983 Monitoring Program, and Maximum PM_{10} Concentrations Measured by Delmarva Power During the 1989 Monitoring Program*

Pollutant	Averaging Period	Highest Concentration (μg/m^3)	NAAQS (μg/m^3)
SO_2	Annual	9	80
	24-hr	51	365
	3-hr	145	1300
PM_{10}	Annual	22	50
	24-hr	90	150
NO_2	Annual	21	100

3.2 GEOLOGY

3.2.1 Regional Geology

The Dorchester site is located within the Atlantic Coastal Plain physiographic province (Rasmussen and Slaughter 1957; Mack *et al.* 1971; Hansen 1972; Cushing *et al.* 1973; Owens and Denny 1979; Bachman 1984). The Atlantic Coastal Plain consists of a thick wedge (approximately 4,000 feet thick) of Cretaceous and younger sediments that overlie the basement bedrock. The sediments are semi-lithified to unconsolidated sand, gravel, silt and clay, with occasional shell layers (Hansen 1972).

The sediments in Dorchester County have been divided into stratigraphic units based on lithology and paleontology. Table 3-2 summarizes the classification and description of regional geologic formations and equivalent hydrogeologic units in the vicinity of the site. The uppermost sediments are Holocene in age. The Holocene sediments are primarily stream deposits, which are found in narrow bands along streams and rivers. Typically, the Holocene sediments form a thin surface veneer and are limited to floodplains.

Table 3 -2 ***Stratigraphic and Hydrogeologic Units in the Vicinity of the Dorchester Site***

System	Series (Group)	Geologic Unit	Approximate Thickness (feet)	Hydrogeologic Unit	Generalized Formation Description
Quaternary and Tertiary (?)	*Pleistocene and Pliocene (?) (Columbia Group)*	Columbia Group Undifferentiated	70	Columbia Aquifer	Sand, fine- to coarse-grained, silt present, clay and silty fine sand in uppermost portion, moderately sorted, iron stained quartz grains common.
Tertiary	*Miocene (Chesapeake Group)*	St. Mary's Formation	110	Confining layer	Clayey sand, fine grained, and sandy, silty clay, shell fragments common.
		Choptank Formation	≥ 103	Frederica (Choptank) Aquifer	Shells and shell fragments, fine to coarse grained sand with occasional greenish color.
		Calvert Formation	~ 200 (a)	Cheswold Aquifer	Sand, diatomaceous silt, clay and shell beds.
	Eocene	Piney Point Formation	unknown	Piney Point Aquifer	Quartz sand, glauconitic, with shell beds.

After Bachman 1984
(a) Rasmussen and Slaughter 1957

The Columbia Group consists of Pleistocene (and possibly Pliocene) age sediments of variable thickness (Table 3-2) underlying the Holocene deposits. The formations within the Columbia Group include: Parsonsburg Sand, Omar Formation, Walston Silt, Beaverdam Sand, and Pensauken Formation. The Columbia Group comprises primarily sand and gravel, with some silt and clay. At the Dorchester site, Columbia Group sediments are primarilly the Beaverdam Sand, which is composed of light colored, fine to coarse grained sand (Bachman 1984; Owens and Denny 1986).

The Chesapeake Group underlies the Columbia Group. It is a sequence of sediments composed of sand, silt, and clay of Miocene age. The St. Mary's, Choptank and Calvert formations, in descending order, are the Chesapeake Group formations identified near the Dorchester site. The St. Mary's Formation consists of clay, silt, fine sand, and silty clayey sand. It is estimated to be approximately 110 feet thick near Vienna (Bachman 1984). The St. Mary's is expected to directly underlie the Columbia Group.

Fine sand, clay, and shell beds comprise the Choptank Formation. Available information indicates that the Choptank is at least 100 feet thick near Vienna (Bachman 1984). The Calvert Formation contains sand, silt, clay, and shell beds (Bachman 1984). It is estimated to have an average thickness of approximately 200 feet throughout Caroline, Dorchester, and Talbot Counties (Rasmussen and Slaughter 1957).

The Piney Point Formation underlies the Calvert Formation. Quartz sand, glauconite, and shell fragments comprise the majority of this formation. The elevation of the top of the Piney Point Formation is approximately 550 feet below sea level in the Vienna area (Williams 1979). Specific information on the thickness of the formation near Vienna is not available as no wells have completely penetrated the formation in this area.

3.2.2 *Site Geology*

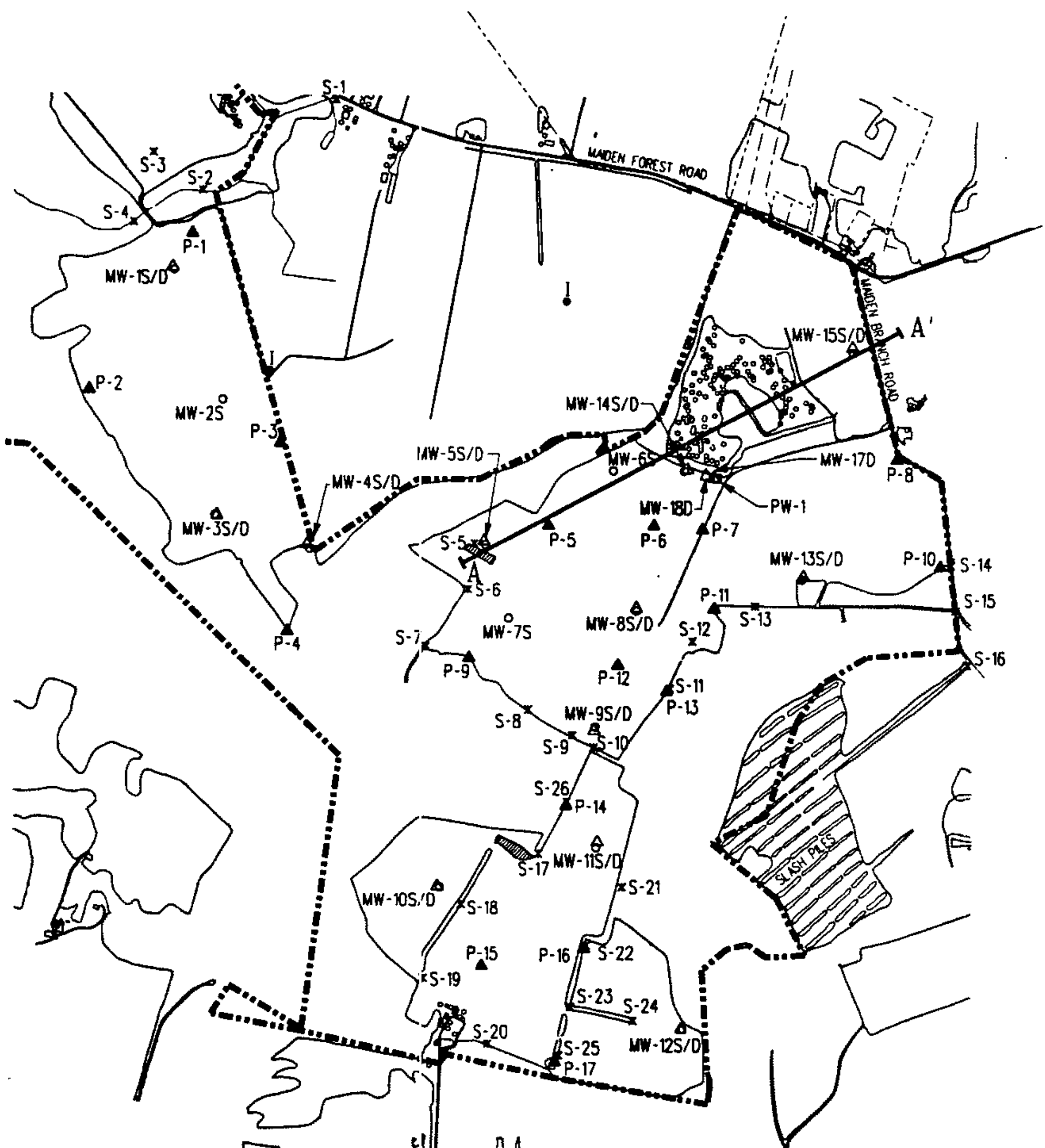
A geologic and hydrogeologic investigation of the Dorchester site was completed in September 1993. It was conducted in accordance with the 16 April 1993 work plan jointly prepared by PPRP and Delmarva Power. Figure 3-2 shows the locations of 17 shallow piezometers, 28 ground water monitoring wells (clustered as shallow and deep wells in the Columbia Aquifer) and 26 staff gauges completed as part of this investigation. The site geologic description presented below is based on the results from the site investigation. The PPRP document titled *Draft Report of the Geologic and Hydrogeologic Investigation of Delmarva Power and Light Company's Proposed Dorchester Power Plant Site, Dorchester, Maryland, 5 November 1993* (Rafalko and Keating 1993) provides a detailed description of the site geology and results of the geologic and hydrogeologic investigation.

Figure 3-3 is a detailed geologic cross section through the proposed power block. It represents a conceptual model of the Dorchester site geology interpreted from soil samples and geophysical logs collected during the development of the monitoring wells. Due to the large distances between the boreholes (several hundred feet), and abrupt discontinuities typical of Coastal Plain geology, variations in lithology likely occur on a scale smaller than that shown.

Unconsolidated sand and gravel, with subordinate amounts of clay and silt, comprise approximately 100 feet of upper sediments on the site. These sediments are interpreted as undifferentiated deposits of the Columbia Group. At depth, the Columbia Group is underlain by a distinctly dense, sandy silty clay unit interpreted to be the St. Mary's Formation.

The lithology underlying the site is relatively uniform. No continuous clay or silt layers are found within the Columbia Group on the site, only

Figure 3-2
Ground Water and Surface Water Monitoring Locations
Dorchester Site



LEGEND

- △ DEEP MONITORING WELL
- ○ SHALLOW MONITORING WELL
- □ PRODUCTION WELL (1 ONLY)
- ● IRRIGATION WELL
- ▲ PIEZOMETER
- × STAFF GAUGE
- PROJECT SITE BOUNDARY
- FARMERS POND (MANMADE)
- A——A' TRACE OF GEOLOGIC X-SECTION

NOTES

1. COORDINATES ARE BASED ON MARYLAND STATE GRID SYSTEM
2. MW-17D IS LOCATION OF EXPLORATORY BORING

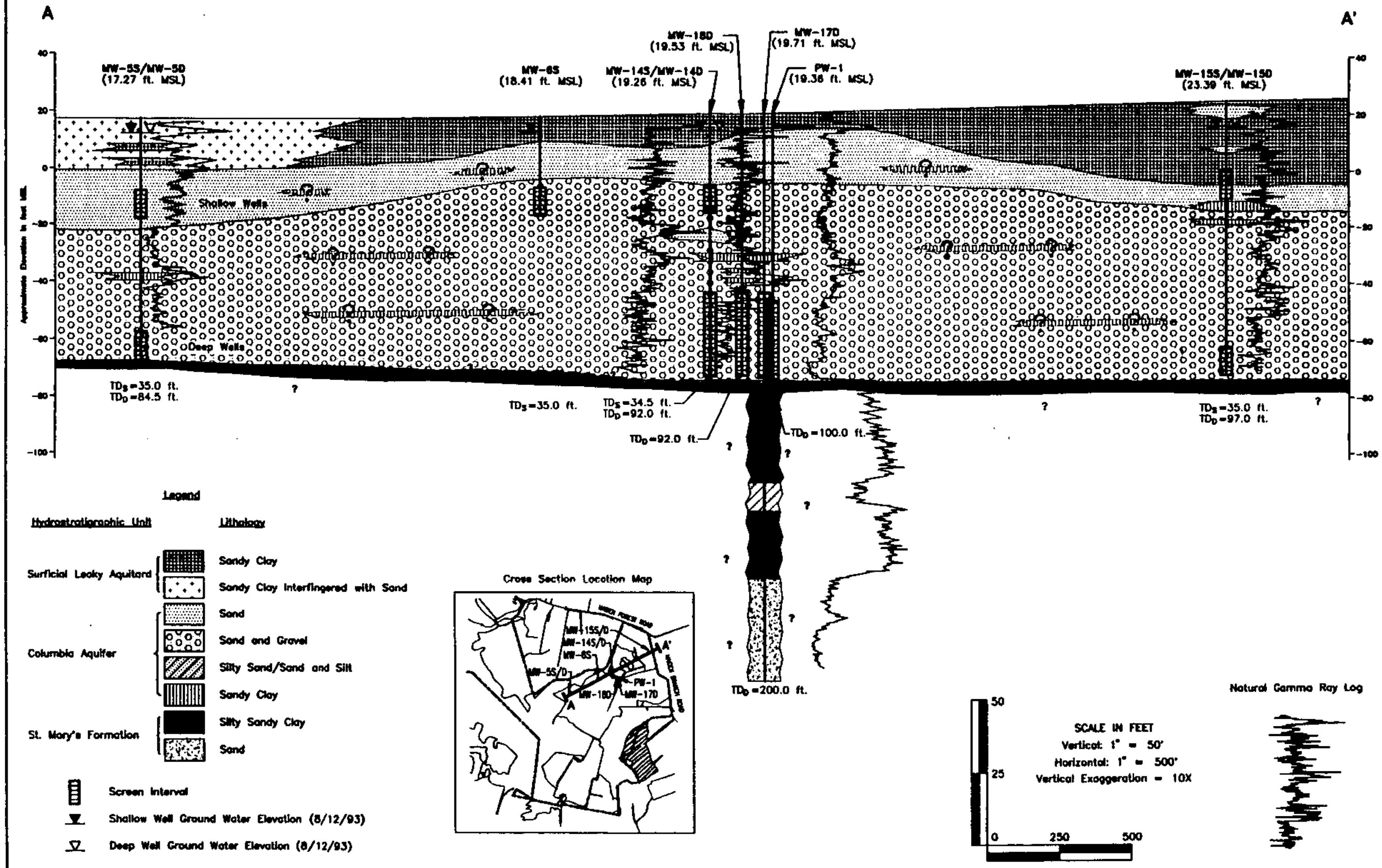
1" = 1500'

1000 500 0 1000 2000

Scale in Feet

15417.63.01/04.06.94-DST/A114

Figure 3-3
Geologic Cross Section Through Power Block
Dorchester Site



small discontinuous clay laminae and lenses within the predominant sand and gravel matrix. Four lithologic subunits and one unit are prevalent at the site, each of which is discussed below.

- *Clayey Sand to Sandy Clay*—This subunit comprises the uppermost sediments of the Columbia Group. Clay is the dominant texture, with interfingered sand laminae in some areas, varying in color from brown to light grey. This subunit is pervasive throughout the northern and southern parts of the site, and absent on the western part. It thickens to the northeast, and extends from the ground surface to depths of about 10 to 30 feet. During drilling, ground water was generally encountered within 5 feet of the ground surface.

- *Sand Interfingered with Clay Laminae*—This subunit is generally encountered within the shallow sediments of the Columbia Group, in the western and southern parts of the site. The sediments are light grey to brownish grey, well sorted, medium to fine sand, containing a trace gravel and clay. The geophysical logs confirm the predominance of sand in this unit, and the presence of discontinuous, interfingering clay laminae of variable thickness. Where present, the facies is about 30 feet thick.

- *Sand*—The sand subunit consists of sand with occasional clay and gravel lenses in the Columbia Group. This facies was encountered throughout the site at depths ranging from the ground surface to 30 feet, and varied in thickness from 10 to 40 feet. The sediments are characterized as light grey to brownish grey, well sorted, medium to fine sand, with a trace of gravel and clay.

- *Sand and Gravel*—This is the deepest lithologic subunit within the Columbia Group, and is continuous across the entire site. The sediments are light grey to brown, well sorted, medium to coarse sand and gravel with trace grey to brown clay. This subunit occurs at a depth ranging from 30 to 90 feet below ground surface, and ranges in thickness from 40 to 70 feet.

- *St. Mary's Formation*—Underlying the Columbia Group is a brown to red dense, sandy silty clay interpreted to be the St. Mary's Formation of the Chesapeake Group. The St. Mary's Formation is a regional geologic feature, and is laterally extensive across the site. The top of this unit is approximately 85 to 100 feet below the ground surface. Exploratory boring at MW-17D (Figure 3-2) was the only one to completely penetrate the St. Mary's Formation, which was logged as about 70 feet thick.

3.2.3 *Site Topography*

The Dorchester site is relatively flat, exhibiting only slight undulations in the land surface. On the basis of the United States Geologic Survey (USGS) topographic quadrangle maps, Rhodesdale, Mardela Springs, East New Market, and Chicamacomico River quadrangles (Figure 3-4), the approximate elevation of the site ranges from 15 to 25 feet above sea level. The topography slopes primarily to the south towards the Chicamacomico River; a smaller portion of the site slopes to the east towards Maiden Branch Road.

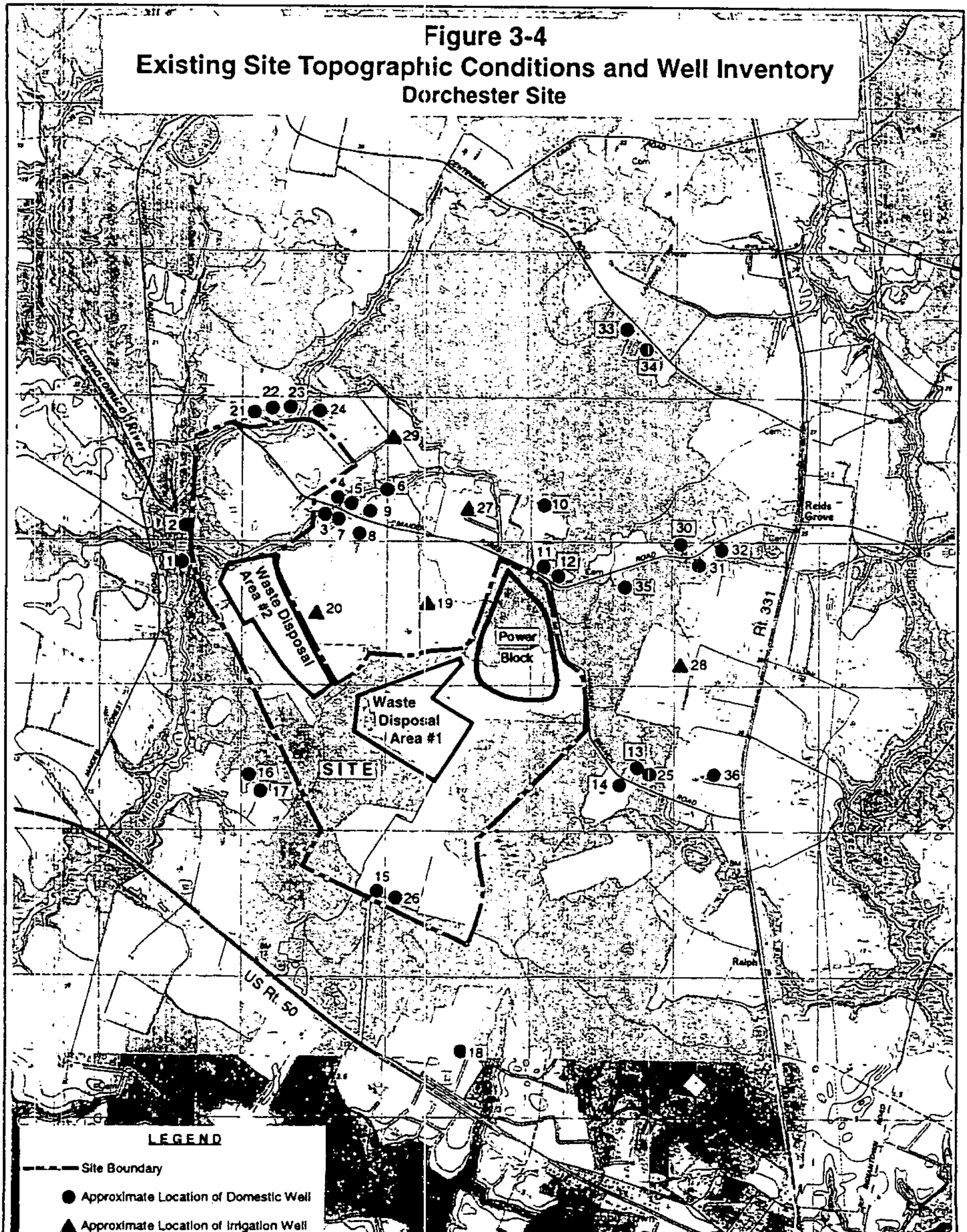
On the basis of observations made by ERM during the geologic and hydrogeologic investigation, overland flow is not a significant hydrologic feature of the site during and after precipitation events. Rather, numerous manmade drainage ditches direct surface runoff off site. The majority of the surface runoff is directed from the northeast to the southwest, toward the Chicamacomico River (approximately 1,000 feet west of the western site boundary). Surface water from the eastern part of the site also flows in the direction of Chicone Creek (about 8,000 feet east of the eastern site boundary); the area contributing runoff to Chicone Creek is relatively minor compared to the area contributing runoff to the Chicamacomico River.

3.2.4 *Site Soils*

The proposed Dorchester Unit 1 site includes the following 12 soil series: Downer, Evesboro, Fallsington, Fort Mott, Galestown, Hambrook, Hammonton, Hurlock, Ingleside, Klej, Pone, and Woodstown. The seasonal high water table for these soils range from 0 to greater than 6 feet; soil drainage characteristics range from very poorly drained to excessively drained. Three of these soil series are characterized as hydric (soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part), and 10 as prime farmland soils. Table 3-3 presents a summary of the soils located on the Dorchester site, linear facilities, and coal unloading facility (Delmarva Power Phase II CPCN application, 1993, pgs 2.3.1-1 - 2.3.1-9). Figure 3-5 presents the soil series on the site and the linear facilities.

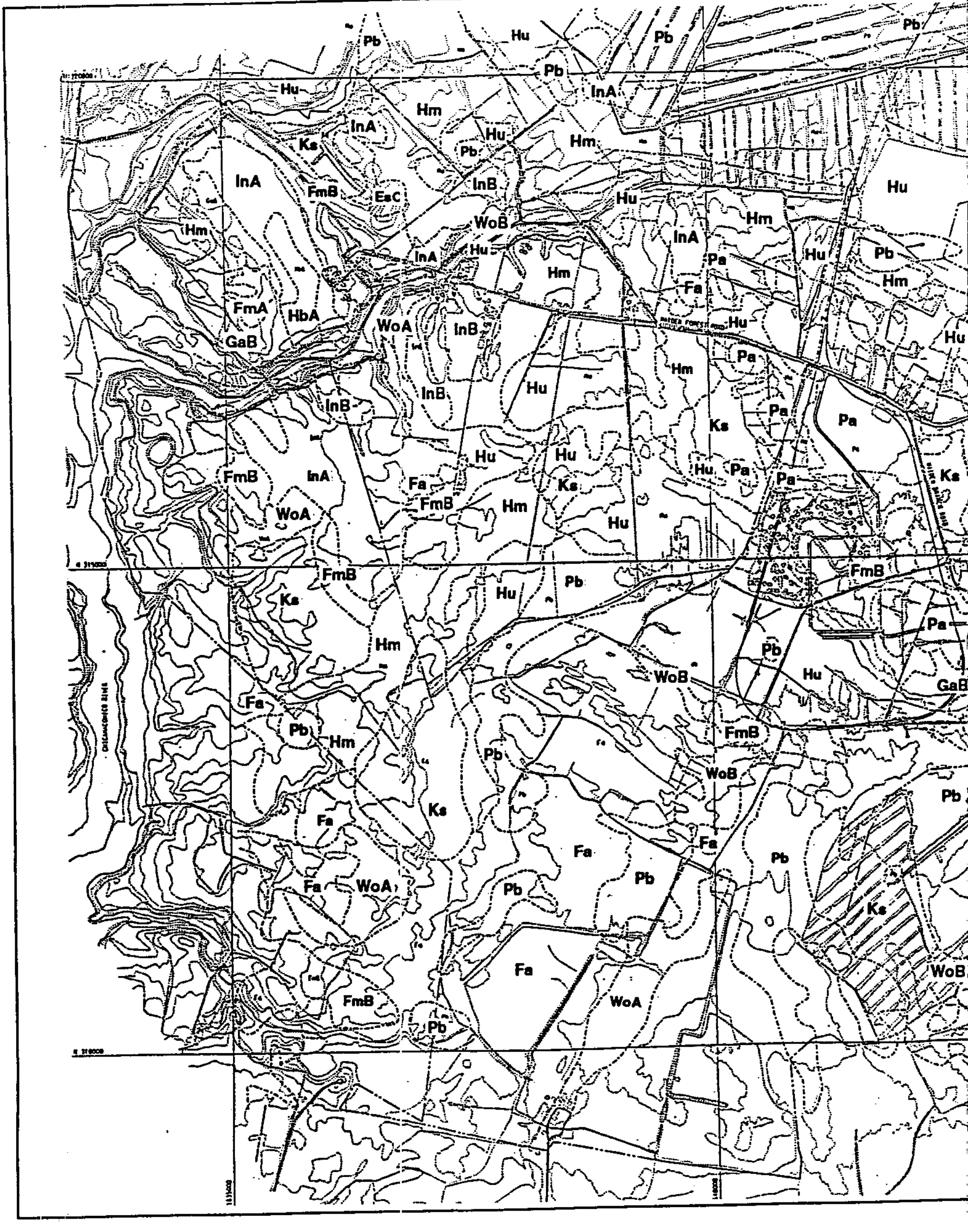
Fallsington, Hurlock and Pone soils are very poorly drained hydric soils, with a depth to seasonal high water table from 0 to 1 foot. Downer, Evesboro, Fort Mott, and Galestown, are well drained to excessively drained, with a depth to seasonal high water table greater than 6 feet.

Figure 3-4
Existing Site Topographic Conditions and Well Inventory
Dorchester Site



Source: USGS Topographic Quadrangles, Rhodesdale, Mardela Springs, East New Market, and Chicamacomico River, Maryland.

15421.42 EK/SC 7-12-95



Pb
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InA
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WoB
Pb
Ks
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Fa
Pb
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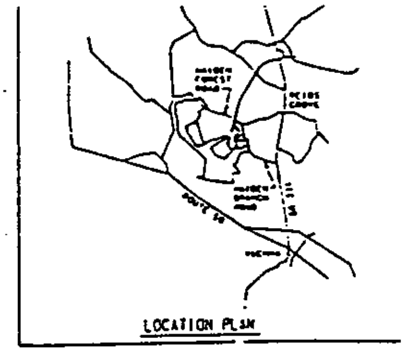
Figure 3-5
Topographic Soil Type Boundaries (Revised)
Sheet 1 of 2
Dorchester Site



LOCATION PLAN

SOIL LEGEND

MAP SYMBOL	SOIL TYPE	HYDROLOGIC SOIL GROUP
EvC	EVESBORO SAND, 5 TO 10 PERCENT SLOPES	A
Fa	FALLSINGTON SANDY LOAM	B
FmA	FORT MOTT LOAMY SAND, 0 TO 2 PERCENT SLOPES	A
FmB	FORT MOTT LOAMY SAND, 2 TO 5 PERCENT SLOPES	A
GaA	GALESTOWN LOAMY SAND, 0 TO 2 PERCENT SLOPES	A
GaB	GALESTOWN LOAMY SAND, 2 TO 5 PERCENT SLOPES	A
HmA	HAMBROOK LOAM, 0 TO 2 PERCENT SLOPES	B
Hm	HAMMONTON SANDY LOAM, 0 TO 5 PERCENT SLOPES	C
Hu	HURLOCK SANDY LOAM	D
InA	INGLESIDE SANDY LOAM, 0 TO 2 PERCENT SLOPES	B
InB	INGLESIDE SANDY LOAM, 2 TO 5 PERCENT SLOPES	B
Ks	KLEJ-HAMMONTON COMPLEX, 0 TO 2 PERCENT SLOPES	B
Pa	PONE MUCKY SANDY LOAM	D
Pb	PONE MUCKY LOAM	D
WoA	WOODSTOWN SANDY LOAM, 0 TO 2 PERCENT SLOPES	C
WoB	WOODSTOWN SANDY LOAM, 2 TO 5 PERCENT SLOPES	C

NOTES

1. COORDINATES ARE BASED ON MARYLAND STATE GRID SYSTEM (1983).
2. TOPOGRAPHIC SOIL TYPES AND AREA DELINEATIONS ARE BASED ON INFORMATION PROVIDED BY SOIL CONSERVATION SERVICE, DORCHESTER COUNTY DISTRICT OFFICE AND ARE BASED ON USDA "SOIL SURVEY", 1982.

LEGEND

——-—-——	PROPERTY LINES
————	EXISTING CONTOURS
------------	SOIL TYPE BOUNDARIES

REFERENCE DRAWINGS

DR-[illegible]-E-00415 SHT NO. 2	TOPOGRAPHIC SOIL TYPE BOUNDARIES

Source: Delmarva Power, Phase II CPCN Application, 1993 (Figure 3.8.2-4).

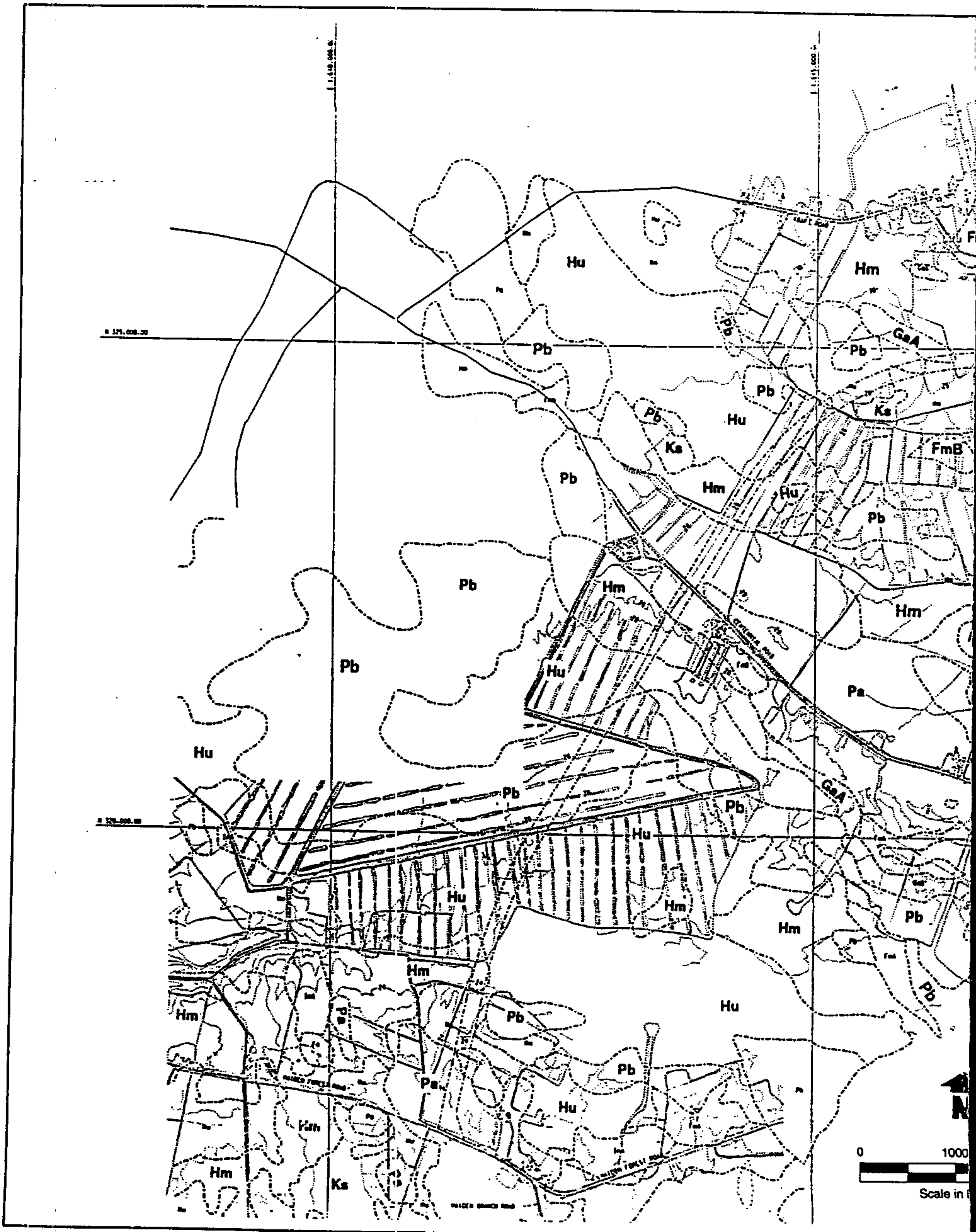
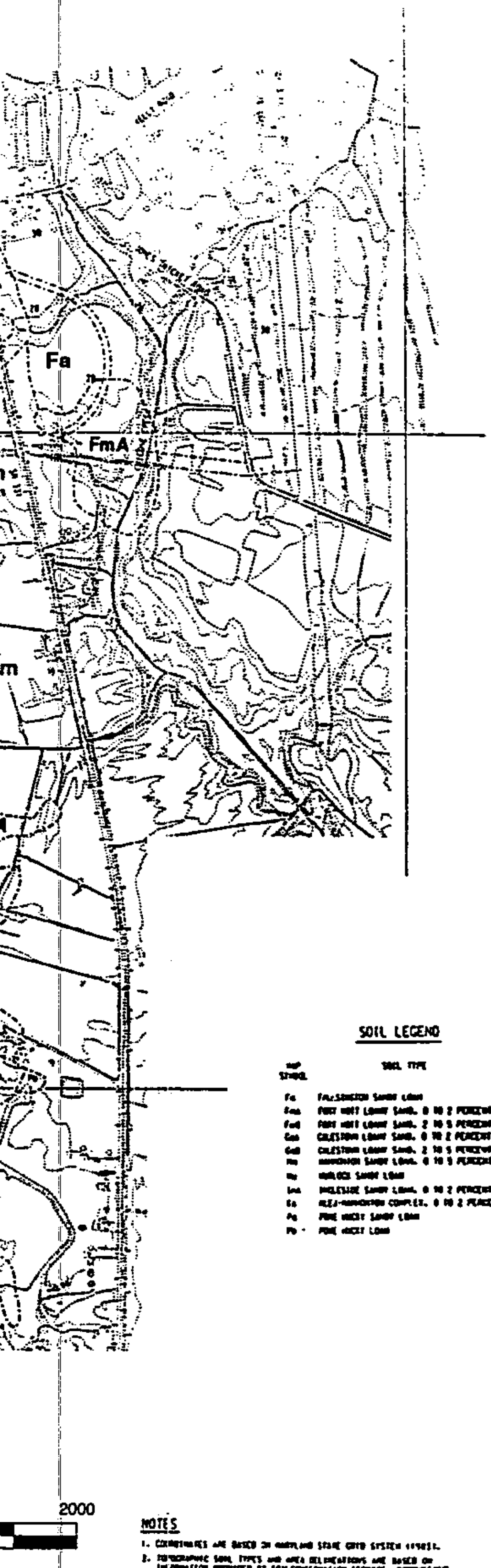
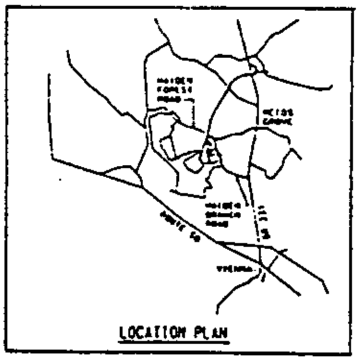

Hu
Pb
Hm
GaA
Ks
FmB
Pa
0
1000
Scale in

Figure 3-5
Topographic Soil Type Boundaries
Sheet 2 of 2
Dorchester Site





SOIL LEGEND

LEGEND

REFERENCE DRAWINGS

NOTES

Source: Delmarva Power, Phase II CPCN Application, 1993 (Figure 2.3.1-1).

15419 42 EK/ES 5-20-94

Table 3-3 Soils Located on the Dorchester Site, Linear Facilities, and Coal Unloading Facility

Soil Series & Letter code	Estim. Depth to Seasonal High Water Table	Drainage Characteristics	Hydric Soils	Prime Farmland	Descrip	Percent Slope	Pwr Block	Project Area By-Product Disposal Area 1	Area 2	Trans Line	Rail Spur	Pipe-line	Access Road	Coal Barge Unload Facil.	Notes: Limiting factors
Downer	> 6 ft	Well Drained to Excessively Drained		Yes								x	x		
DoA					sandy loam	0 - 2 %									
DoB					sandy loam	2 - 5 %									
Evesboro *	> 6 ft	Well Drained to Excessively Drained													
Esc					sand	5 - 10 %									
Fallsington	0 - 1 ft	Very Poorly to Poorly Drained	x	where drained				x				x	x		high water table
Fa					sandy loam										
Fort Mott	> 6 ft	Well Drained to Excessively Drained		where irrigated			x	x	x			x	x		
FmA					loamy sand	0 - 2 %									
FmB					loamy sand	2 - 5 %									
Galestown	> 6 ft	Well Drained to Excessively Drained		where irrigated			x					x	x		Rapid perme-ability & low moist-ure holding capacity; perched water table
GaA					loamy sand	0 - 2 %									
GaB					loamy sand	2 - 5 %									
Hambrook	4 - 6 ft	Well Drained		Yes								x		x	
HbA					loam	0 - 2 %									
Hammon-ton	1.5 to 3.5 ft	Moderately Well Drained		Yes				x	x	x	x	x			
Hm					sandy loam	0 - 5 %									

Table 3-3 ***Soils Located on the Dorchester Site, Linear Facilities, and Coal Unloading Facility (Continued)***

Soil Series & Letter code	Estim. Depth to Seasonal High Water Table	Drainage Characteristics	Hydric Soils	Prime Farmland	Descrip	Percent Slope	Pwr Block	Project Area By-Product Disposal Area 1	Area 2	Trans Line	Rail Spur	Pipe-line	Access Road	Coal Barge Unload Facil.	Notes: Limiting factors
Hurlock	0 - 1 ft	Very Poorly to Poorly Drained	x	where drained			x	x		x	x	x	x		
Hu					sandy loam										
Ingleside	4 - 6 ft	Well Drained		Yes					x			x			
InA					sandy loam	0 - 2 %									
InB					sandy loam	2 - 5 %									
Klej	1 - 2 ft	Somewhat Poorly to Mod. Well Drained		where drained			x		x			x	x		high water table
Ks					complex	0 - 2 %									
Pone	0 - 1 ft	Very Poorly to Poorly Drained	x				x	x		x	x	x			
Pa					mucky sandy loam										
Pb					mucky loam										
Woodstown	1.5 to 3.5 ft	Moderately Well Drained		yes				x	x			x	x	x	season-ally high water table
WoA					sandy loam	0 - 2 %									
WoB					sandy loam	2 - 5 %									

* - Evesboro soils are located within the property lines but not within the area to be developed
References:
Soil Series, Description and % Slope: Delmarva Power, Phase II CPCN application, revised soil section, Table 2.3.1-1
Seasonal High Water Table & Drainage Characteristics: Delmarva Power, Phase II CPCN application, revised soils section, Table 2.3.1-3
Hydric Soils: Hydric Soils of Dorchester County document; Corps of Engineers Wetlands Delineation Manual
Prime Farmland: Delmarva Power, Phase II CPCN application, 1993, Section 2.2.8

Hambrook and Ingleside soils are well drained, with the depth to seasonal high water table at 4 to 6 feet. Hammonton and Woodstown are moderately well drained; depth to the seasonal high water table is 1.5 to 3.0 feet. Klej soils are somewhat poorly to moderately well drained; depth to the seasonal high water table is 1 to 2 feet (Delmarva Power Phase II CPCN application, pg 2.3.1-1 to 2.3.1-3).

Downer, Hambrook, Hammonton, Ingleside, and Woodstown soils are prime farmland soils, and Fallsington, Fort Mott, Galestown, Hurlock, and Klej soils are prime farmland soils where modified through draining or irrigation (Delmarva Power, Phase II CPCN application, 1993, Section 2.2.8). Evesboro soils occur on the site, but not within the portion proposed for development (Delmarva Power, Phase II CPCN application, 1993, pg 2.3.1-1 to 2.3.1-3).

Fort Mott, Galestown, Hurlock, Klej, and Pone are the soil series comprising the power block area. Hurlock and Pone predominate, these are hydric soils with a seasonal high water table between 0 and 1 feet. Fort Mott soils also occur in the middle of the power block. These soils constitute a lesser but significant portion of the area and are well drained to excessively drained, with seasonal high water tables of greater than 6 feet.

Fallsington, Hurlock, Pone, Woodstown, Hammonton, and Fort Mott soil series comprise Waste Disposal Area 1. The hydric Fallsington soils predominate, they have a seasonal high water table between 0 and 1 feet. Ingleside, Klej, Fort Mott, Woodstown, and Hammonton soil series comprise Waste Disposal Area 2. Although the area has no predominant soil series, most of the soils are characterized as well drained.

Pone, Hurlock and Hammonton soil series are located in the transmission line/rail spur corridor. Hurlock and Pone, hydric soils with seasonal high water tables between 0 and 1 feet, appear to constitute the majority of the corridor.

Pone, Hurlock, Fallsington, Klej, Woodstown, Hammonton, Hambrook, Ingleside, Downer, Galestown, and Fort Mott soil series comprise the cooling water pipeline corridor. Hurlock, Fallsington, Klej, Woodstown, Downer, Galestown, and Fort Mott soil series comprise the plant access road.

Woodstown and Hambrook soils comprise the coal barge unloading facility and intake/discharge structure, with Hambrook soils representing the significant portion. Hambrook soils are well drained with season high water table between 4 and 6 feet.

3.3 *WATER RESOURCES*

3.3.1 *Ground Water*

3.3.1.1 *Regional Hydrogeologic Conditions*

The Columbia Aquifer within the Pleistocene age deposits of the Columbia Group, the Frederica (Choptank) and Cheswold Aquifers within sediments of the Chesapeake Group, and the Piney Point Aquifer in the Piney Point Formation (Table 3-2) have been identified underlying the Dorchester site (Bachman 1984). Delmarva Power proposed withdrawing ground water from the Columbia Aquifer.

A brief description of each of these aquifers is presented below, based on existing information. However, existing information about the thickness, potential yield, and water quality of the aquifers below the Columbia Aquifer near Vienna is limited. The deepest well drilled in the area, apparently screened in the Piney Point Aquifer, had a total depth of 560 to 585 feet (WRA 1989). Published well records indicate that other wells in the Vienna area have been screened in the shallower aquifers within the Chesapeake Group.

Columbia Aquifer

Regionally, the Columbia Aquifer is an unconfined to semi-confined aquifer within the Columbia Group. Interbedded silt and clay lenses may result in areas of semi-confined conditions. The saturated portion of the Columbia Group forms the Columbia Aquifer.

The Columbia Aquifer's hydraulic properties indicate that it is capable of producing large quantities of ground water in areas where there is a significant saturated thickness. Transmissivity values range from about 95,000 gallons per day per foot (gpd/ft) to 175,000 gpd/ft (Mack *et al.* 1971; Bachman 1984). Transmissivity is the capacity of the aquifer to transmit ground water. Ground water recharge to the Columbia Aquifer results from infiltration of precipitation. From the investigation at the former Vienna Unit 9 site, located about 2 miles southeast of the Dorchester site, Geraghty and Miller (1980) estimated a recharge rate of 11 inches per year.

The ground water quality of the Columbia Aquifer is good. Bachman (1984) report slightly acidic ground water with low concentrations of dissolved solids, sulfate, and chloride. Concentrations of dissolved iron and nitrate-nitrogen vary over a wide range; nitrate-nitrogen concentrations range from less than detection to 27 milligrams per liter (mg/l) (Bachman 1984).

Chesapeake Group Aquifers

Existing information indicates the presence of a water-bearing zone below the St. Mary's Formation. This water-bearing zone is approximately 280 to 330 feet below sea level at Vienna. Wells installed to this depth by the Town of Vienna in 1934 and 1945 demonstrated the potential of this zone to yield ground water (Rasmussen and Slaughter 1957). Prior to 1979, Delmarva Power also withdrew an average of approximately 20,000 to 25,000 gallons per day (gpd) from a well approximately 310 feet deep at the Vienna power plant (PPRP 1988).

The transmissivity of the Chesapeake Group aquifers is low due to the limited thickness and discontinuous nature of the water-bearing sediments (Mack *et al.* 1971). Rasmussen and Slaughter (1957) reported a transmissivity of approximately 6,000 gpd/ft and storativity of 0.003. Storativity is the volume of water that an aquifer can absorb or expel when the hydraulic head changes.

Limited water quality data are available for this aquifer near Vienna. The data indicate that the water quality in the Chesapeake Group aquifers is high in silica (30 to 60 mg/l) and dissolved solids (217 to 1,270 mg/l), with moderate iron content (0.1 to 3.0 mg/l) and low hardness (48 to 196 mg/l as calcium carbonate) (Mack *et al.* 1971).

Piney Point Aquifer

The Piney Point Aquifer is a confined aquifer (artesian) associated with the Piney Point Formation, underlying the Calvert Formation (the lower formation of the Chesapeake Group within the region). This aquifer is a major source of ground water in some areas of eastern Maryland, but little is known about the aquifer in the Vienna area. Williams (1979) estimated that the aquifer to be 50 to 75 feet thick in the Vienna region. The transmissivity of the Piney Point Aquifer near Vienna has been estimated at 800 gpd/ft, based upon specific capacity data. Storativity for the Piney Point ranges from 0.00009 to 0.0004. Available water quality data for the Piney Point aquifer indicate the water has a low iron and chloride content, a moderate concentration of dissolved solids, and may have a hydrogen sulfide odor (Mack *et al.* 1971).

The only well identified near Vienna that is deep enough to penetrate the Piney Point Aquifer is a 560-foot well owned by Delmarva Power (WRA 1989). MDE/WMA, records indicate that a test pumping rate of 40 gpm was obtained from this well and that the pumping rate for the well permit application was 150 gpm. The well appears to be screened at a depth of 540 feet. No information on the quality of water obtained from this well was available.

3.3.1.2 *Local Ground Water Use*

Ground water is a source of potable and agricultural water supply in the vicinity of the Dorchester site. In July and August 1993, Delmarva Power inventoried wells within about 2,000 feet from the perimeter of the site. Table 3-4 lists the results of the well inventory; Figure 3-4 indicates the location of the wells inventoried.

All of the wells identified by Delmarva Power are for agricultural and domestic use. The largest ground water withdrawals are from irrigation wells. Many of the domestic wells are completed at depths over 200 feet; indicating completion within the aquifers of the Chesapeake Group rather than the Columbia Aquifer. Conversely, the irrigation wells are completed at depths of about 100 feet in the Columbia Aquifer. Typically, irrigation wells operate for 30 to 45 days per year at a pumping rate of about 1,000 gpm.

3.3.1.3 *Site Hydrogeologic Conditions*

The ground water flow system beneath the site was delineated into three hydrostratigraphic units based upon the ability of the units to transmit ground water. Figure 3-6 illustrates the site hydrostratigraphy. The units are interpreted as the Surficial Leaky Aquitard, the Columbia Aquifer and the St. Mary's Formation. Each of these units is discussed below.

Surficial Leaky Aquitard

The Surficial Leaky Aquitard consists of the fine grained sediments of the sandy clay to clayey sand lithologic subunits. The lithology indicates that this unit does not readily transmit ground water. The aquitard appears to be present in the northern and southern parts of the site but absent in the western part (Figure 3-7). Ground water was encountered in the borings at depths as shallow as 2 feet. After precipitation events, ponding at the ground surface was evident at several well locations on the northern part of the site. The presence of the leaky aquitard is a probable cause of the occurrence of wetland hydrology found on the site. Horizontal ground water flow directions should be very localized, following short flow paths that reflect topography.

Figure 3-6
Schematic of Site Hydrostratigraphy
Dorchester Site

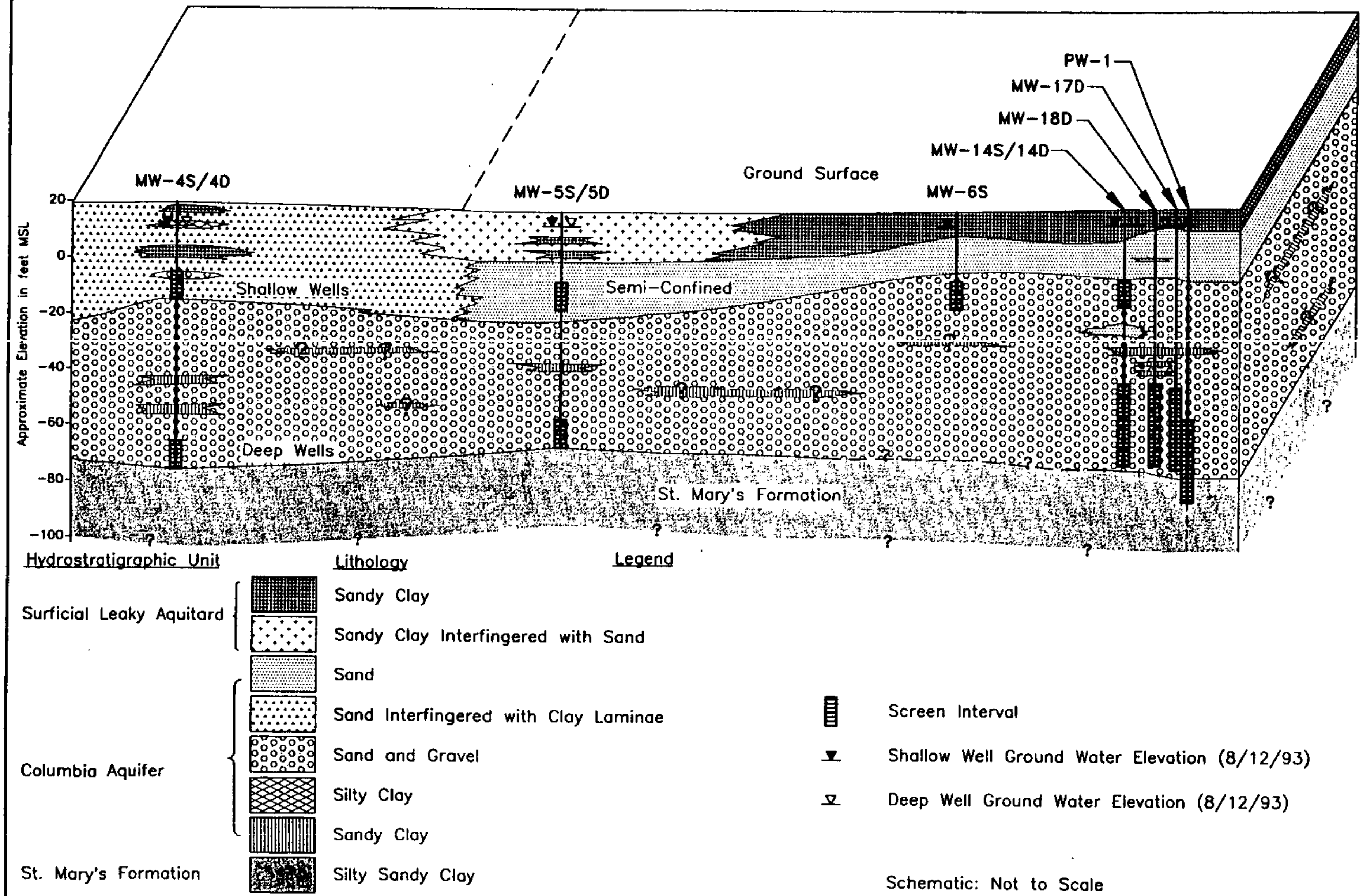


Figure 3-7
Thickness Contour Map of the Surficial Leaky Aquitard
Dorchester Site

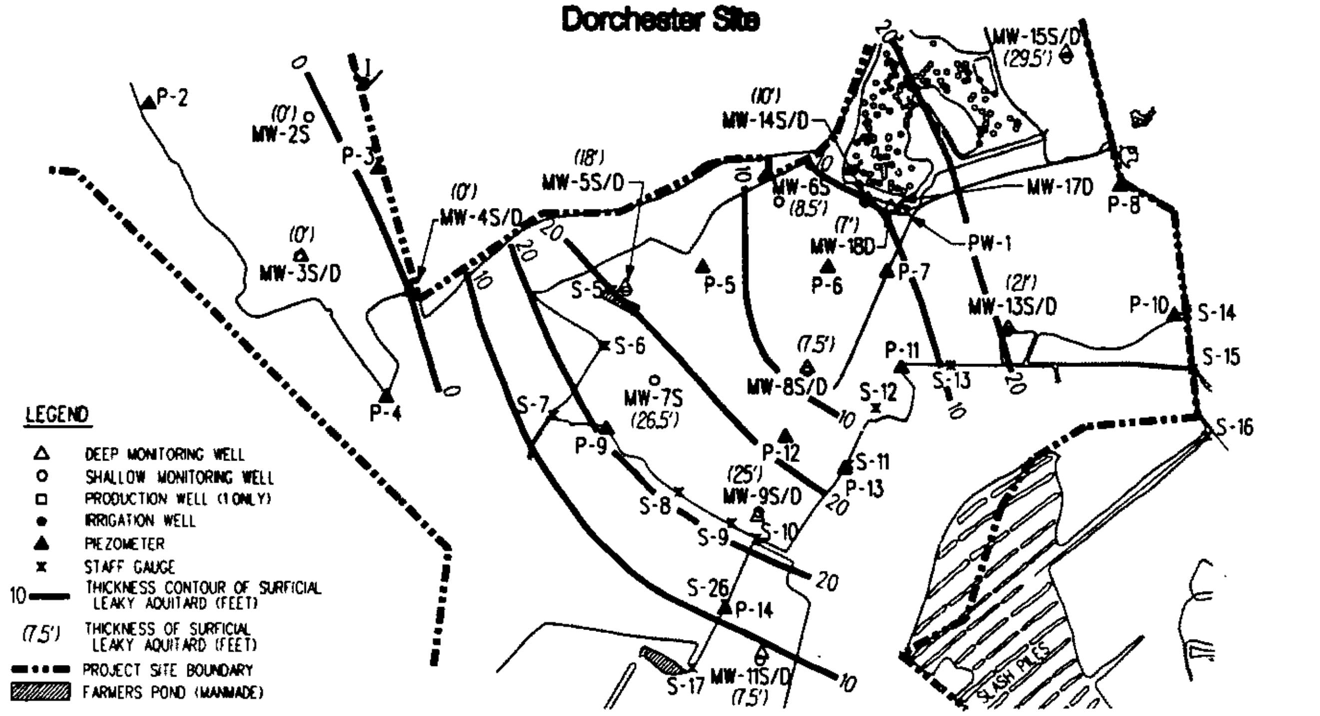
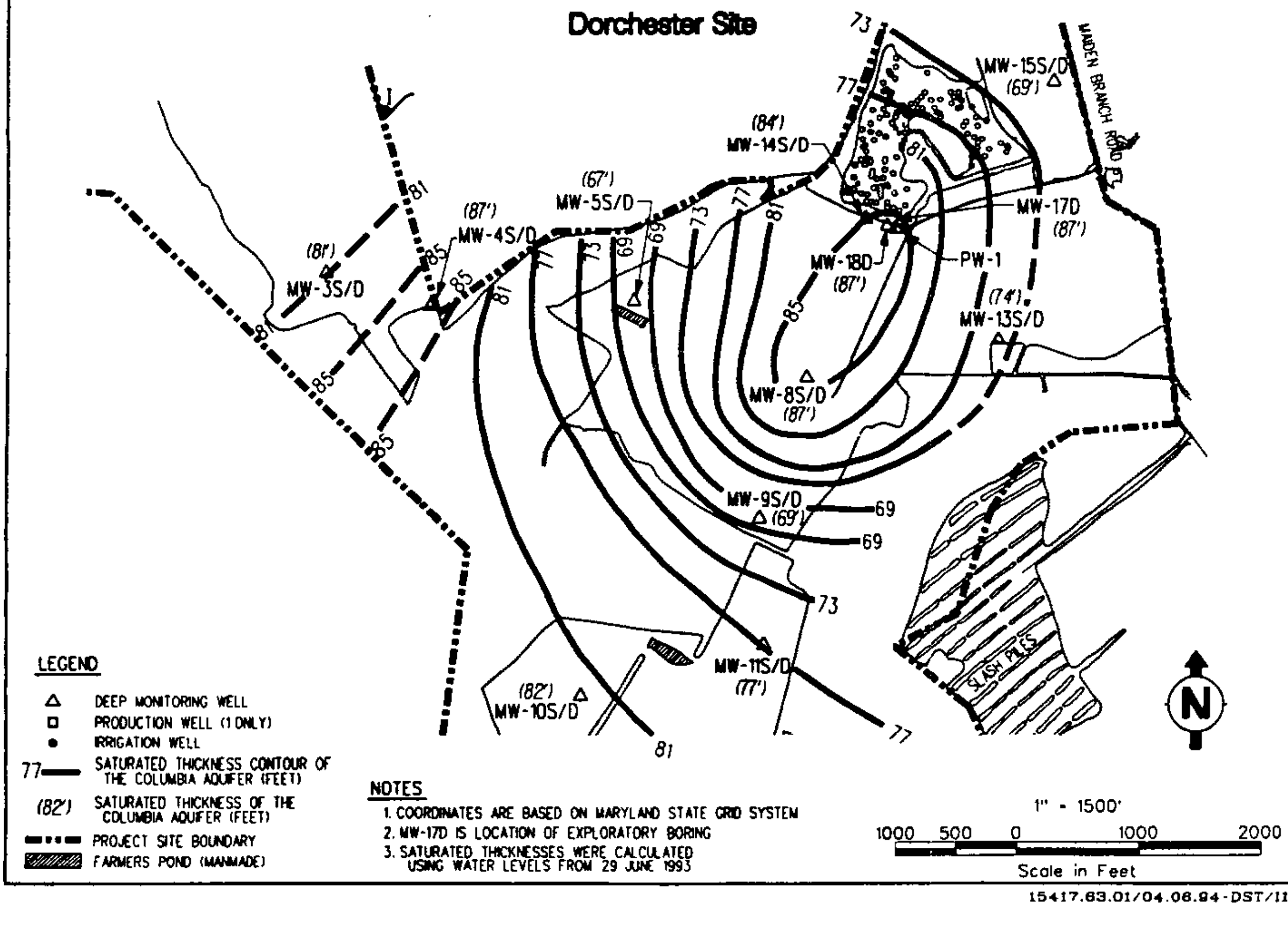


Figure 3-8
Saturated Thickness Contour Map of the Columbia Aquifer
Dorchester Site



15417.63.01/04.06.94-DST/1105

Table 3-4 Well Inventory for the Dorchester Site

Well No.	Use	Approx. Depth (feet)	Comments
1	Domestic	220	DO-810549
2	Domestic	240	
3	Domestic	unknown	
4	Domestic	290	DO-73-1401
5	Domestic	260	
6	Domestic	260	
7	Domestic	260	
8	Domestic	289	
9	Domestic	75	
10	Domestic	20	
11	Domestic	180	
12	Domestic	180	
13	Domestic	325	DO-73-1273
13A	Domestic	290	
14	Domestic	215	DO-88-0897
15	Domestic	shallow	
16	Domestic	15	
17	Domestic	200	
18	Domestic	unknown	
19	Irrigation	100	
20	Irrigation	100	
21	Domestic	220	
22	Domestic	60	Not used
23	Domestic	50	Abandoned
24	Domestic	unknown	DO-88-0881
25	Domestic	~90	
26	Domestic	shallow	
27	Irrigation	100	
28	Irrigation	100	
29	Irrigation	100	
30	Domestic	220	
31	Domestic	250	
32	Domestic	250	
33	Domestic	250	
34	Domestic	280	
35	Domestic	300	
36	Domestic	218	

Information provided by Earth Data, Inc. on behalf of Delmarva Power.
Wells were inventoried in July and August 1993.

Columbia Aquifer

The Columbia Aquifer underlies the Surficial Leaky Aquitard. It consists of the sand, sand and gravel, sand interfingered with clay laminae, and silty clay lithologic subunits. Where the leaky aquitard is present, the Columbia Aquifer is geologically semi-confined; where absent, the Columbia Aquifer is geologically unconfined. Vertical leakage through the leaky aquitard, direct infiltration of precipitation, and lateral ground water flow originating off site to the north recharge the aquifer.

The saturated thickness of the Columbia Aquifer ranges from approximately 70 to 90 feet throughout the site. Figure 3-8 presents a contour map of saturated thickness for the Columbia Aquifer. The thickest portion of the aquifer appears to be near test well PW-1 (Delmarva Power will convert this into the production well for plant operation) in the power block.

Ground Water Flow Conditions of the Columbia Aquifer on the Dorchester Site

Since Delmarva Power proposed withdrawing water only from the Columbia Aquifer, PPRP's hydrogeologic field investigation focused on this aquifer. Horizontal ground water flow patterns are southerly at shallow and deep depths within the Columbia Aquifer. Vertical hydraulic gradients within the aquifer are very low (typically less than 0.1 percent), indicating very similar hydraulic heads vertically throughout the aquifer. These observations, together with the generally sand and gravel texture, indicate that the Columbia Aquifer behaves as a single hydrostratigraphic unit on site.

Ground water and surface water elevations were examined from March 1993 through September 1993 to determine lateral ground water flow directions for the Columbia Aquifer. Figures 3-9A and 3-9B show ground water elevation contours for shallow and deep wells, respectively, for 12 August 1993. These ground water flow patterns are typical of the ground water flow patterns for the remaining ground water elevation data.

Ground water flow (interpreted from the shallow and deep wells) is predominantly to the south or southwest, toward the Chicamacomico River. Lateral hydraulic gradients are low (much less than one percent), reflecting the lack of significant topographic relief or streams on site, and the high hydraulic conductivity of the Columbia Aquifer. The hydraulic gradients ranged from about 0.0004 to 0.002.

Figure 3-9A
Ground Water Elevation Contour Map for Shallow Wells
Columbia Aquifer, 12 August 1993
Dorchester Site

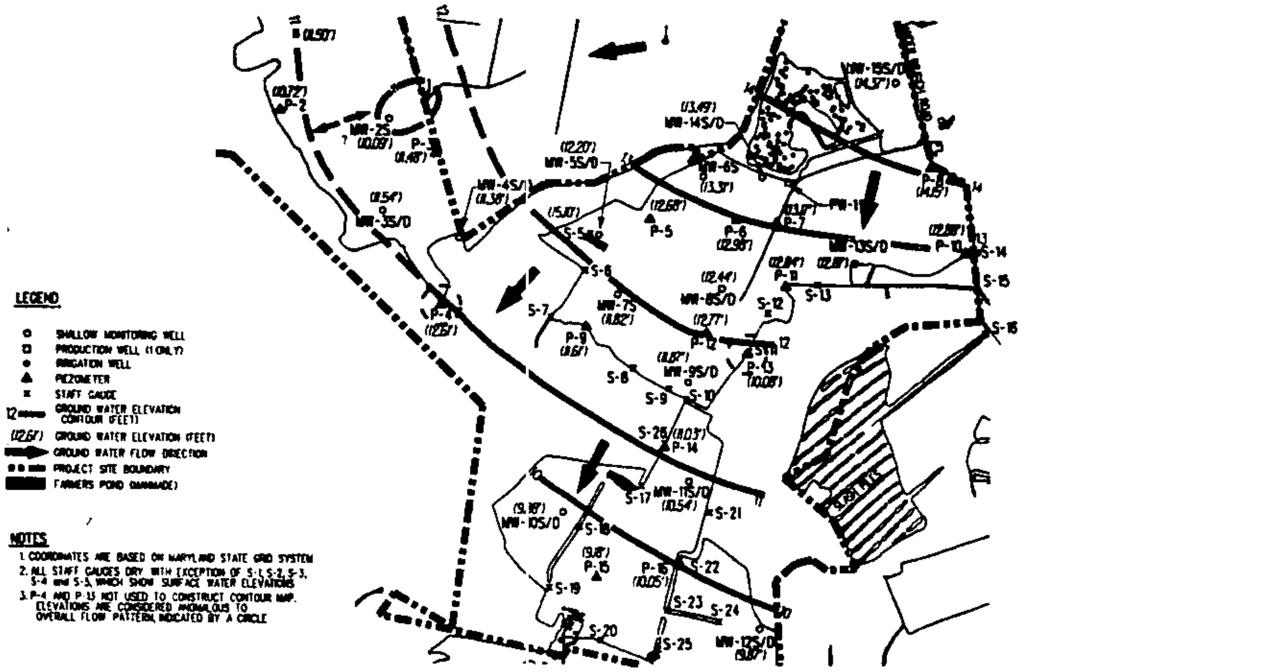
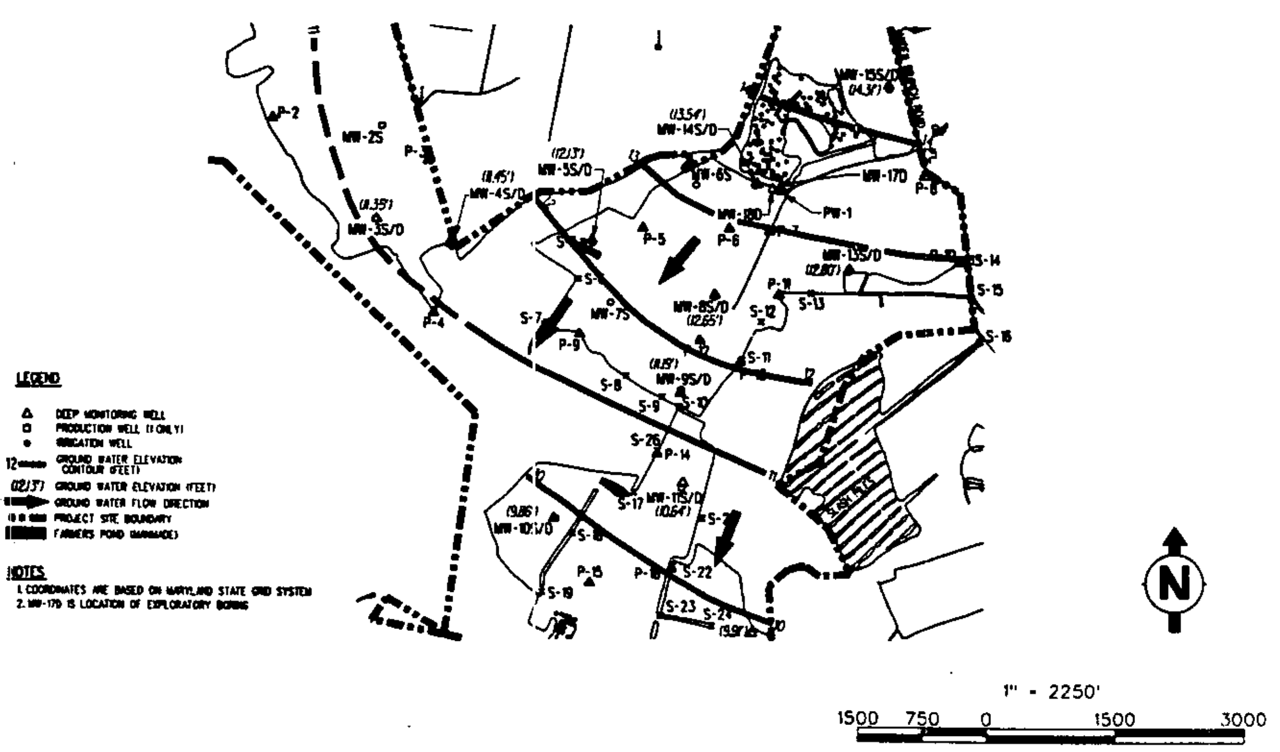


Figure 3-9B
Ground Water Elevation Contour Map for Deep Wells
Columbia Aquifer, 12 August 1993
Dorchester Site



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